

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Preserving the Open Internet)	GN Docket No. 09-191
)	
Broadband Industry Practices)	WC Docket No. 07-52

COMMENTS OF CORNING INCORPORATED

Timothy J. Regan
Senior Vice President, Global Government Affairs
Corning Incorporated
325 7th Street, NW, Suite 600
Washington, DC 20004
(202) 661-4155 (voice)
(202) 661-4165 (fax)

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TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	i
INTRODUCTION AND SUMMARY	1
I. EVIDENCE DEMONSTRATES AN URGENT NEED FOR INCREASED SPEED IN OUR NATION’S BROADBAND NETWORK.....	2
II. SIGNIFICANT PRIVATE INVESTMENT IS NEEDED TO UPGRADE OUR NATION’S BROADBAND NETWORK TO NEXT GENERATION CAPABILITY	7
III. EVIDENCE SUGGESTS THE PRIVATE SECTOR MAY BE RELUCTANT TO INVEST IN WIDESPREAD DEPLOYMENT OF NEXT GENERATION BROADBAND CAPABILITY	9
IV. RECOMMENDATIONS FOR BROADBAND REGULATIONS THAT WILL NOT IMPEDE INVESTMENT IN NEXT GENERATION BROADBAND CAPABILITY	12
A. The Commission Should Use Its Title I Authority In Adopting Broadband Regulations	14
B. The Commission Should Maintain The Flexibility To Enforce Broadband Regulations On A Case-by-Case Basis.....	14
C. A Nondiscrimination Standard Should Only Prohibit Unreasonable Discrimination.....	15
D. Reasonable Network Management and Managed/Specialized Services Should Be Presumptively Permissible Under The Broadband Regulations	16
CONCLUSION.....	18

EXECUTIVE SUMMARY

Substantial private sector investment must be made in our nation's broadband network to achieve the President's goal of creating an "advanced information technology ecosystem." Such an ecosystem must be widespread, be high-speed, enable future video-based applications, and restore American leadership in terms of broadband performance. These are all characteristics that are inherent in next generation broadband capability that is widely deployed.

The existing broadband network in the United States does not meet these standards. An investment of \$100 billion or more will be necessary to upgrade America's broadband network to next generation capability to serve a large portion of American households. The private sector must necessarily be the source of that investment, but it appears reluctant to make the commitment.

In light of this urgent need, the Commission should exercise caution in adopting new regulations in this proceeding that will exacerbate the investment climate. Accordingly, Corning recommends that, if the Commission decides to adopt regulation in this proceeding, the regulation be shaped in a way so as not to impede private investment in next generation broadband capability. Such regulation, if it must be adopted, should be imposed under the authority of Title I, be applied on a case-by-case basis, prohibit "unreasonable discrimination" that is anti-competitive or is substantially harmful to subscribers, and presumptively allow reasonable network management and managed services.

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Corning Incorporated (“Corning”) hereby respectfully submits the following comments in the above-referenced proceeding.¹

INTRODUCTION AND SUMMARY

There are two fundamentally different solutions to remedy the perceived congestion problem that gives rise to this proceeding: (1) increase investment in network capacity to eliminate or mitigate congestion; or (2) increase regulation on broadband providers to mitigate the perceived negative symptoms of network management. Although in some circumstances both solutions may be appropriate, increased investment to expand network capacity is the “ultimate cure,” while prescriptive network management regulations may constitute mere “band-aids.” The Commission must take care in this proceeding not to adopt regulations (the band-aids) that will impede investment in network capacity (the cure).

¹ See *Preserving the Open Internet, Broadband Industry Practices*, Notice of Proposed Rulemaking, GN Docket No. 09-191, WC Docket No. 07-52, FCC 09-93 (rel. October 22, 2009) (“NPRM”).

Corning is the worldwide leader in the production and sale of optical fiber with over 350 patents in the field. As the inventor of the first low-loss single-mode optical fiber and the manufacturing process for such fiber, Corning brings a unique perspective to this proceeding concerning how regulatory prescriptions may affect future investment in next generation networks. Accordingly, we explain below the need for increased broadband network investment, describe the looming investment crisis, and recommend guidelines that the Commission should employ to ensure that any regulation it adopts in this proceeding does not impede broadband network investment.

I. EVIDENCE DEMONSTRATES AN URGENT NEED FOR INCREASED SPEED IN OUR NATION'S BROADBAND NETWORK

Beyond the need to alleviate congestion, the United States must adopt policies to ensure that providers upgrade their broadband networks to create an “advanced information technology ecosystem.” This is a primary objective in the President’s Innovation Strategy. It correctly characterizes the importance of widespread, high-speed Internet access as:

“... essential for economic growth, job creation, and global competitiveness, and will foster the next generation of innovators while enabling reductions in energy consumption through telework, making online distance education tools accessible to all, enhancing remote medical monitoring capabilities, facilitating civic engagement, and supporting enhanced communications networks for first responders.”²

² See *A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs*, White House National Economic Council, Sept. 2009, p. 14, <http://www.whitehouse.gov/administration/eop/nec/StrategyforAmericanInnovation> (last visited on January 13, 2010).

Unfortunately, our nation's broadband network is neither "widespread" (in the sense that it is not universally available) nor is it "high-speed."

The FCC's own data shows that broadband is not widespread and that substantial investment must be made to achieve ubiquity. In its November 18, 2009 report to the Commission, the team developing the National Broadband Plan ("the Broadband Team") reported that 3 to 6 million households do not have access to any broadband capability.³ The Broadband Team estimated that \$20 billion will have to be invested to bring broadband (defined as 0.768 to 3 Mbps downstream, a very slow version of broadband) to these unserved households.⁴

The Broadband Team further reveals that much of the available broadband capacity is not "high-speed." It reported that the median broadband speed actually delivered downstream to American households is 3 Mbps.⁵ The Team did not report on the median actual upload speed, but Corning believes it is substantially below 1 Mbps.⁶

These speeds cannot be characterized fairly as "high-speed" because they are insufficient, according to the Broadband Team, to deliver the new and emerging video-based services that

³ See *Broadband Gaps*, Presentation made by the Broadband Team during the FCC Open Meeting, November 18, 2009, p. 8.

⁴ See Presentation made by the Broadband Team during FCC Open Meeting, September 29, 2009, p. 45.

⁵ *Id.* at 26.

⁶ In its Speed Matters project, the Communications Workers of America report that average upload speeds from their natural survey was 1.1 Mbps. Since median speeds are almost always below average speeds, it is reasonable to assume that the median upload speed is less than 1 Mbps. See A Report on Internet Speeds in All 50 States at <http://www.speedmatters.org/content/resources> (last visited on January 13, 2010).

consumers will want and need. These emerging real-time video services like enhanced video conferencing for telework, telelearning, and telemedicine require 5 to 10 Mbps of actual symmetric throughput, according to the Broadband Team's report.⁷ These services are essential to support the President's goals to reduce the threat of global warming through reduced travel, improve the quality of education, and enhance the efficiency and effectiveness of the medical delivery system. They simply cannot be delivered over the median speeds of 3 Mbps downstream and less than 1 Mbps upstream that are generally available today.

Moreover, broadband capability currently available to U.S. households cannot be characterized as "high-speed" because it compares very unfavorably to the broadband performance in other countries. In its worldwide rankings, the Organization for Economic Cooperation and Development (OECD) reports that the United States is 19th in terms of average advertized downstream speeds.⁸ A more comprehensive examination of relative broadband performance presented in the Commission-sponsored Berkman Center study also shows U.S. broadband performance lagging the rest of the world.⁹ This study ranked broadband performance for OECD countries across a range of criteria including maximum advertized speeds, average advertized speeds, median upload and download actual test speeds, latency, and

⁷ Broadband Gaps, *supra* note 3, at 23.

⁸ See Organization for Economic Cooperation and Development Broadband Portal, Average advertised download speeds, by country (Sept. 2008), http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html (last visited on January 13, 2010).

⁹ See *Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world*, The Berkman Center for Internet & Society at Harvard University, October 2009, p. 57.

other factors. The Berkman Center study rated the U.S. broadband performance at 13th in the world.¹⁰

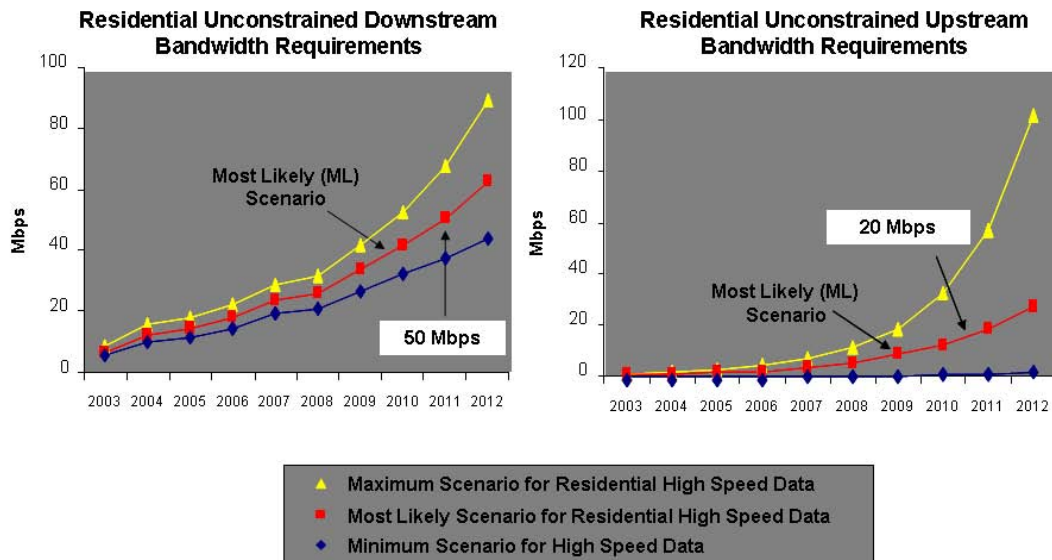
Beyond fulfilling the President's mandate to create an "advanced information technology ecosystem," our national broadband network needs to be upgraded to next generation capability in order to enable new, yet-to-be developed applications. Many of these applications will be video-based and therefore will require the bandwidth most closely associate with truly next generation networks. Cisco Systems' research shows that in the future video will predominate Internet traffic. Specifically, Cisco estimates that video in all its forms (TV, VoD, Internet, and P2P) will account for close to 90 percent of all consumer Internet traffic in 2012.¹¹

As indicated in Figure 1 below, we project that on average consumers will need 50 Mbps downstream and 20 Mbps upstream by 2011 to enable these new applications. The analysis upon which these projections is based is sophisticated. It uses modern modeling techniques including Fisher-Pry substitution, Gompertz substitution, Linear Regression, and Monte-Carlo simulation. The projections provide a range of potential outcomes. The red line in Figure 1 reflects the speed requirements over time for the average residential user.

¹⁰ *Id.*

¹¹ *Approaching the Zettabyte Era*, Cisco Systems, Inc., 2008.

Figure 1
Projected Unconstrained Residential Bandwidth Demands, 2002-2012



Source: Corning Cable Systems (model will be made available to the Commission upon request)

The reasonableness of Corning’s projections that consumers will want and need bandwidth of 50 Mbps downstream and 20 Mbps upstream is supported by the work of the Cambridge Strategic Management Group (CSMG) as reflected in Table 1 below. CSMG estimates the bandwidth requirements for “advanced HD video” at 64 Mbps to 256 Mbps and “3D/HD video” at 32 Mbps. In addition to entertainment, these high definition video described by CSMG in Table 1 will provide the quality necessary to enable telework, telelearning, and telemedicine.

Table 1
Applications Enabled By NGA Broadband

	Description	Example	Requirements
Advanced HD Video	<ul style="list-style-type: none"> Next-gen super high-resolution video: <ul style="list-style-type: none"> Quad HD: 3840 x 2160 (2160p)¹ Ultra HD: 7680 x 4320 (4320p)¹ 	<ul style="list-style-type: none"> Technical approaches are being defined² Quad HD hardware in development³; currently available in Japan Ultra HD undergoing testing in Japan¹ 	<ul style="list-style-type: none"> Real-time and streaming: <ul style="list-style-type: none"> Quad HD: 64 Mbps¹ Ultra HD: 256 Mbps¹ Moderate to high QoS requirements
3D/HD Video	<ul style="list-style-type: none"> HD stereoscopic video content Requires 3D-enabled content and hardware (TV set, glasses, etc.) 	<ul style="list-style-type: none"> Leading CE vendors plan to unveil 3D-capable TV sets beginning in 2010¹ Recent 3D movie titles include <i>Toy Story 3</i>, <i>Monsters vs. Aliens</i>, <i>Up</i>, and others⁴ 	<ul style="list-style-type: none"> Real-time and streaming 3D video requires 32 Mbps per stream¹ Moderate to high QoS requirements
Advanced HD/3D Video	<ul style="list-style-type: none"> Combination of advanced HD (Quad or Ultra) and 3D video formats 	<ul style="list-style-type: none"> Philips and other manufacturers have trialed 3D Quad HD TV sets⁵ London 2012 Olympics could potentially be shot in 3D and Quad HD⁶ 	<ul style="list-style-type: none"> Requires 2-4X bandwidth of single Quad/Ultra HD stream¹ Potential for 256+ Mbps requirement Moderate to high QoS requirements
Massive Downloads & Uploads	<ul style="list-style-type: none"> Non real-time downloads and uploads of very large files (10+ GB) including images, videos, etc. 	<ul style="list-style-type: none"> GigaPan & Photosynth stitch 100s of photos together (multi-gigapixel images)¹ Other types of rich imagery are emerging (satellite, panorama, etc.)¹ 	<ul style="list-style-type: none"> 12 min HD video can be uploaded in ~10 min with 10 Mbps Reduced to <10 sec with 1 Gbps Low QoS required (non real-time)
Cloud Computing	<ul style="list-style-type: none"> Computing processing power shifted to the network Desktop machine used as thin client 	<ul style="list-style-type: none"> Cloud-based consumer apps emerging (e.g. Google Docs, MS Office 2010) Potential to drive move to thin client computing 	<ul style="list-style-type: none"> Very high QoS required to minimize latency to sustain program performance Current generation bandwidth is sufficient

Source: *National Broadband Plan Policy Evaluation*, Cambridge Strategic Management Group, October 31, 2009

II. SIGNIFICANT PRIVATE INVESTMENT IS NEEDED TO UPGRADE OUR NATION'S BROADBAND NETWORK TO NEXT GENERATION CAPABILITY

Upgrading the national broadband network to next generation capability in order to alleviate congestion and accommodate new and emerging video-based applications will require a significant investment by the private sector. The Broadband Team estimates that the cost of universal broadband deployment is somewhere between \$20 to \$350 billion depending on the speeds required. Although Corning disagrees with the high end of this estimated range because of the assumptions used,¹² even the more realistic cost estimate for deploying FTTH reflected on

Table 2 shows that a significant investment of \$90 billion must be made to bring next generation

¹²The Broadband Team Report reflects the cost to overbuild an entirely new national fiber-to-the-home (FTTH) network that connects every household in America, which we believe is an unrealistic assumption. A more technically accurate approach is to calculate the incremental cost of passing 80 percent of households with FTTH and connecting only those households that chose to purchase the service. Incremental cost in this context is the cost to pass and connect those households that would not otherwise be passed or connected in the normal course and speed of deployment. Table 2 reflects the cost estimates based on this more realistic assumption.

FTTH capability to 80 percent of American households. This represents the incremental investment necessary to increase the number of homes passed by FTTH from 27 percent by 2015 (the base case on the current course and speed) to 80 percent as demonstrated in Table 2 below.

Table 2
Incremental Investment Required to Pass
Up to 54, 69, & 80 Percent of Households with FTTH by 2015

	Percentiles Covered				
	28 to 54 % Percentile	55 to 69 % Percentile	70 to 80 % Percentile	Not Evaluated	
# 2015 HHS not already Covered by FTTH (M)	34.3	19.1	14.0	25.4	
Cost to Pass (\$B)	\$24.0B	\$23.7B	\$23.2B	NA	\$71.0B
Cost to Connect (\$B)	\$9.3B	\$5.1B	\$3.8B	NA	\$18.2B
Total Investment Requirement (\$B)	\$33.3B	\$28.9B	\$27.0B	NA	\$89.2B

Source: National Broadband Plan Policy Evaluation, Cambridge Strategic Management Group, October 31, 2009

Regardless of the estimate used, the investment required to deploy next generation broadband capability to most of the country is significant. Because the Commission must rely on the private sector to make this huge investment, it certainly is not in the national interest for the Commission to take regulatory action that will impede this investment.

III. EVIDENCE SUGGESTS THE PRIVATE SECTOR MAY BE RELUCTANT TO INVEST IN WIDESPREAD DEPLOYMENT OF NEXT GENERATION BROADBAND CAPABILITY

Unfortunately, it appears that the private sector may be reluctant to make the necessary investment to upgrade the national broadband network to next generation capability. Two troubling indicators reflect this possibility. First, the Commission-sponsored Columbia Institute report filed in the National Broadband Plan proceeding reveals a negative trend in wireline broadband investment through the year 2015.¹³ As Figure 2 and Table 3 indicate, the Columbia Institute estimates that telephone company wireline broadband investment will decline from \$15.5 billion in 2008 to \$12.3 billion in 2015.¹⁴ Wireline broadband investment by the cable TV industry is projected to decrease from \$4.8 billion in 2008 to \$3.1 billion in 2015.¹⁵

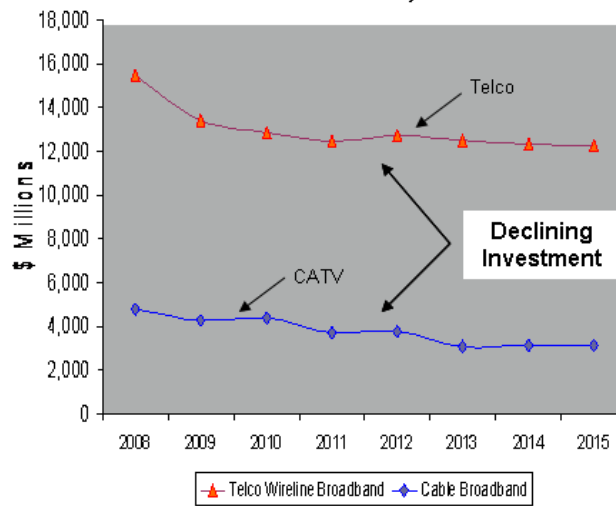
¹³ See *Broadband in America: Where it is and where is it going*, The Columbia Institute for Tele-Information, November 2009, p. 66-68.

¹⁴ *Id.*

¹⁵ *Id.* at 66.

Figure 2

Total Broadband CAPEX for Major Service Providers, 2008-2015



Source: "Broadband in America," Columbia Institute for Tele-Information

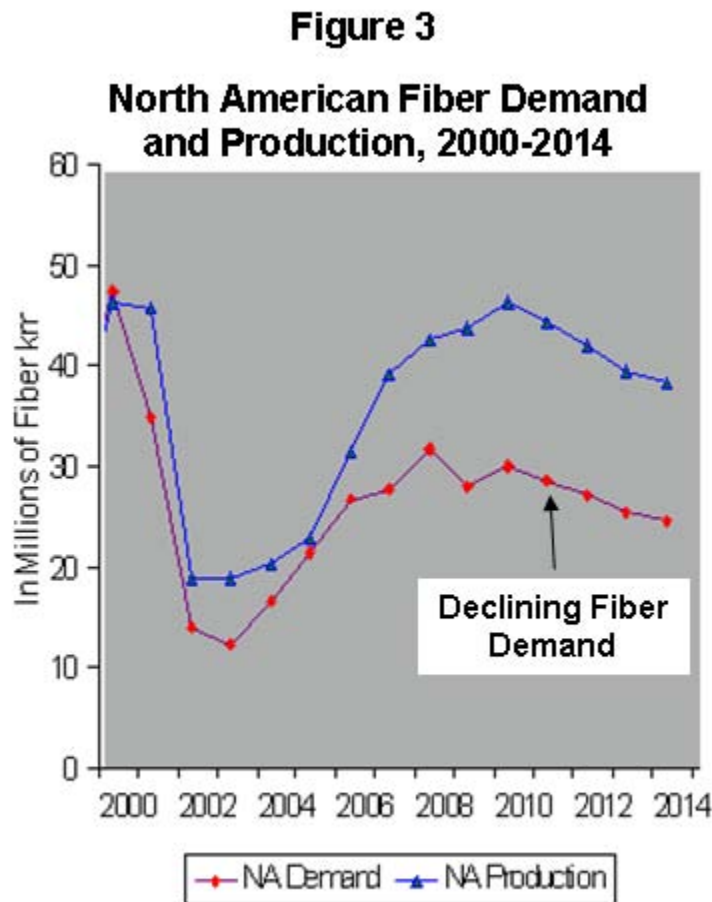
Table 3
Broadband CAPEX By Industry Sector, 2008-2015

	2008	2009	2010	2011	2012	2013	2014	2015
Telco Wireline Broadband	15,499	13,454	12,839	12,439	12,762	12,506	12,341	12,259
Cable Broadband	4,787	4,302	4,408	3,713	3,785	3,111	3,148	3,152

Source: "Broadband in America," Columbia Institute for Tele-Information

Second, experts anticipate a significant decrease in the deployment of optical fiber in the United States over the next several years. As indicated in Figure 3 below on the red line, North American fiber demand peaked in 2008 at 31.7 million fiber kilometers and is expected by CRU Analysis to decline to 24.7 million fiber kilometers by 2014. This drop in fiber demand is being driven by the fact that Verizon will have completed most of its FTTH build in 2010. As a result, investment in FTTH access equipment is expected to decline. TIA finds that U.S. revenue from

the sale of FTTH access equipment peaked at \$4.6 billion in 2008 and will decline to \$1.7 billion in 2012.¹⁶



As Corning has advocated in the context of the National Broadband Plan,¹⁷ the Commission must adopt policies that address this extraordinary decline in investment. Equally

¹⁶ See TIA's 2009 ITC Market Review and Forecast: A comprehensive overview of the information and communications technology markets, June 9, 2009, Figure 2-4.3, p. 2-53.

¹⁷ See Notice of Ex Parte Filing by Corning Incorporated, GN Docket No. 09-51 (December 18, 2009) (entitled *Corning's Strategy for Next Generation Access in National Broadband Plan*).

important, the Commission should not adopt regulations that could exacerbate this trend by further eroding the incentives for future investment.

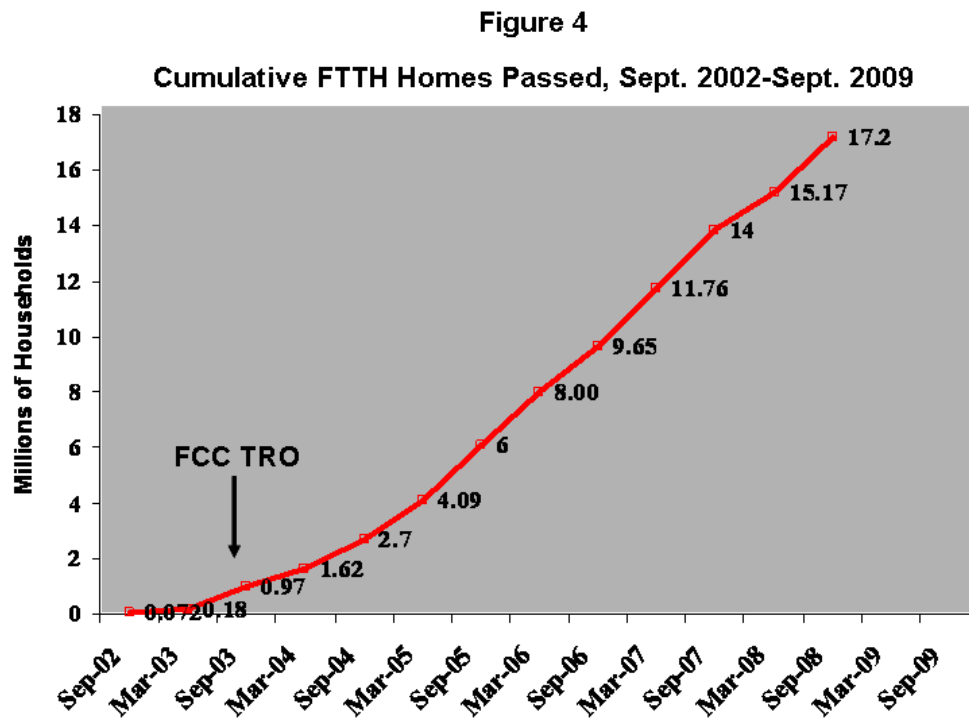
IV. RECOMMENDATIONS FOR BROADBAND REGULATIONS THAT WILL NOT IMPEDE INVESTMENT IN NEXT GENERATION BROADBAND CAPABILITY

The Commission must employ great care when developing regulations in this proceeding to ensure that Internet policy regulation does not further erode the investment climate. Any proposed rule that would inhibit investment in broadband deployment should be discarded as counter productive because ultimately it will exacerbate the congestion problem rather than ameliorate it. The Commission's priority must be to adopt rules that encourage broadband providers to upgrade their broadband networks to next generation capability to accommodate new and emerging video-based applications. Such an approach is necessary for the United States to regain world leadership in all areas relating to its broadband infrastructure.

Regulations adopted by the Commission since 2003, including the Broadband Policy Statement which contained the Internet policy principles, have had a favorable impact on the deployment of fiber optics into our nation's broadband network. This favorable impact is specifically reflected in the tremendous increase in the deployment of FTTH since the Commission adopted its rules under the *Triennial Review Order* (TRO) in 2003.¹⁸ As indicated in Figure 4 below, the number of homes passed with FTTH technology since the TRO was

¹⁸ See *Fiber-to-the-Home Council North American FTTH/FTTP Status*, Presentation by Michael C. Render, September 2009.

adopted has increased from 0.18 million homes to 17.2 million homes.¹⁹ Over \$20 billion in capital has been invested in FTTH over this period of time.



Source: Fiber to the Home council North American FTTH/FTTP Status, Michael C. Render, RVA LLC, September 29, 2009

Given this experience, the Commission should use caution when adopting new regulations that may deter this type of investment because so much more investment is needed to ensure that all Americans have access to the emerging technologies discussed above. Even with the significant investment described in Figure 4, only 17 percent of American households are currently passed by FTTH technology.²⁰ Accordingly, Corning recommends that the

¹⁹ *Id.*

²⁰ *Id.*

Commission be guided by the following recommendations in developing any new regulations in this proceeding. To be clear, we are not recommending new regulations on the Internet. But, if the Commission decides to adopt regulations in this proceeding, we believe that adhering to these recommendations would limit any negative impact that new regulations would have on the investment climate.

A. The Commission Should Use Its Title I Authority In Adopting Broadband Regulations

If the Commission chooses to adopt any new regulations in this proceeding, it must do so under its Title I authority as suggested in the NPRM. Internet access service has been properly classified as a Title I service. Any other classification would violate longstanding and well-reasoned Commission precedent that has been sustained by the Supreme Court.²¹ In fact, a reclassification of Internet access service as a Title II service would create uncertainty around the future regulation of the Internet. This could bring a sudden halt to any investment in the nation's broadband network and only further the bandwidth allocation and congestion problems. As such, if the Commission is to adopt any new regulations in this proceeding, it must act under its Title I authority.

B. The Commission Should Maintain The Flexibility To Enforce Broadband Regulations On A Case-by-Case Basis

The Commission must maintain the flexibility to apply any new regulations adopted in this proceeding on a case-by-case basis because the Internet industry is constantly evolving. *See* NPRM ¶ 89. Internet-related technology is constantly advancing, the services are always

²¹ *See National Cable & Telecommunications Ass'n v. Brand X Internet Services*, 545 U.S. 967 (2005).

improving, and the business models are changing. In this fluid environment, regulation that prohibits specific practices as a matter of rule will run the risk of freezing the market, thereby inhibiting innovation that may prove beneficial to consumers and may generate the financial resources to upgrade network capacity.

For example, a network management practice that appears today to harm consumers theoretically may in fact prove beneficial to consumers in the future because it enables a new, yet-to-developed useful service or application. And, denying the development of these new services or applications could preclude the generation of new revenue streams to finance future network upgrades. A case-by-case analysis will avoid these types of negative unintended consequences. It will also enable the Commission to reserve its decision on whether certain conduct is prohibited until it can take into account all the relevant circumstances under which such conduct was undertaken.

C. A Nondiscrimination Standard Should Only Prohibit Unreasonable Discrimination

While the Commission's nondiscrimination standard should focus on promoting consumer welfare, it should also be sure to spur innovation and investment in the broadband industry. Without such innovation and investment, it will be the consumer that ultimately suffers. In order to accomplish these goals, the Commission's standard should be both predictable for broadband service providers and flexible for the Commission in analyzing future conduct. With the foregoing in mind, the Commission's standard should only prohibit conduct that constitutes "unreasonable discrimination," defined as conduct that is anticompetitive or substantially harmful to consumers. When considering harm to consumers, the Commission

should focus on behavior that is inconsistent with the Commission's consumer protection policies set forth in the Communications Act.

By focusing on unreasonable discrimination that results in anticompetitive conduct, the Commission will be able to perform a case-by-case analysis of any such allegations against a broadband service provider, while at the same time promoting reasonable and competitive conduct that benefits consumers and spurs investment in broadband infrastructure throughout the broadband industry. Limiting this nondiscrimination standard to substantial harm to consumers clarifies that the Commission is not concerned with conduct that may appear harmful to consumers, but in fact is conduct essential to running a broadband network. Disparate treatment among subscribers with different bandwidth usage may prove to be one such practice. Additionally, by restricting this standard to conduct inconsistent with well-settled consumer protection policies in the Communications Act, broadband service providers will be able to predict with better certainty the kind of prohibitive conduct the Commission's regulations had in mind.

D. Reasonable Network Management and Managed/Specialized Services Should Be Presumptively Permissible Under The Broadband Regulations

In order to encourage broadband service providers to actively engage in network management and to offer managed/specialized services, the Commission's regulations should presume that reasonable network management functions and managed/specialized services are permissible. Such a presumption would only be overcome where it is shown that such network management or managed/specialized services are anti-competitive or harmful to consumers as demonstrated by an inconsistency with the Commission's consumer protection policies set forth

-16-

in the Communications Act. This maintains the predictability and flexibility needed to ensure that broadband service providers continue to invest in network upgrades well into the future.

Network management is one of the most important functions of an Internet service provider. It simply wouldn't be possible to function in a safe or reliable manner without such management. The absence of any network management would only harm consumers. The Commission should do everything possible to encourage Internet service providers to continue such management services by presuming that reasonable network management is permissible. This presumption of permissibility should only be overcome where it is shown that the specific network management technique in question is proven to be anticompetitive or harmful to consumers as demonstrated by an inconsistency with the Commission's consumer protection policies set forth in the Communications Act. This creates the predictability needed for Internet service providers to engage in reasonable network management functions, while at the same time allowing the Commission flexible oversight on a case-by-case basis in the future.

Similar to reasonable network management functions, the Commission should presume that managed/specialized services are permissible unless proven to be anti-competitive or harmful to consumers as demonstrated by an inconsistency with the Commission's consumer protection policies set forth in the Communications Act. The Commission will have to first determine the types of services that it considers to be managed/specialized by creating a set of principles that would allow this classification to be made on a case-by-case basis in the future. This presumption and classification standard would provide the predictability and flexibility

needed to ensure broadband service providers continue to provide those managed/specialized services beneficial to consumers.

CONCLUSION

For the reasons set forth above, the Commission should proceed with caution in this proceeding to not adopt any regulations that would further the congestion problem by impeding broadband network investment.

Respectfully submitted,

By: /s/ Timothy J. Regan
Timothy J. Regan
Senior Vice President, Global Government Affairs
Corning Incorporated
325 7th Street, NW, Suite 600
Washington, DC 20004
(202) 661-4155 (voice)
(202) 661-4165 (fax)

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